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Atom interferometer detection of dark matter

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Atom interferometers and gradiometers have unique advantages in searching for various kinds of dark matter (DM). Our work focus on light DM scattering and gravitational effect from macroscopic DM in such experiments.

First we discuss sensitivities of atom interferometers to a light DM subcomponent at sub-GeV masses through decoherence and phase shift from spin-independent scatterings. Benefiting from their sensitivities to extremely low momentum deposition and the coherent scattering, atom interferometers will be highly competitive and complementary to other direct detection experiments, in particular for DM subcomponent with mass $m_\chi \leq 10$ keV.

As an excellent accelerometer, atom gradiometers can also be sensitive to macroscopic DM through gravitational interactions. We present a general framework for calculating phase shifts in atom interferometers and gradiometers with metric perturbations sourced by time-dependent weak Newtonian potentials. We derive signals from gravitationally interacting macroscopic DM and found that future space missions like AEDGE could constrain macroscopic DM fractions to less than unity for DM masses around $m_{\mathrm{DM}} \sim 10^7$ kg.

Mini Symposia (Invited Talks Only)

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